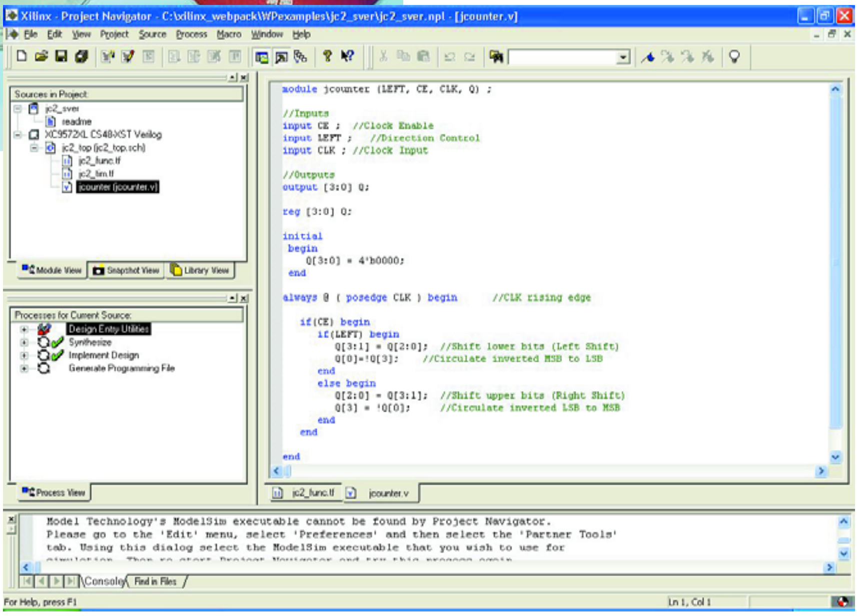
CoolRunner-II

Xilinx CPLD Development Kit

By Paul Goossens

Here's a brief article about an attractive development kit from our friends at Xilinx, which is not only rich in contents but also affordable for the hobbyist! The board is supplied ready-built and comes with two CD-ROMs crammed with software.



```
module jcounter (LEFT, CE, CLK, Q) ;

//Inputs
input CE ;  //Clock Enable
input LEFT ;   //Direction Control
input CLK ; //Clock Input

//Outputs
output [3:0] Q;

reg [3:0] Q;

initial
 begin
    Q[3:0] = 4'b0000;
 end

always @ ( posedge CLK ) begin      //CLK rising edge

   if(CE) begin
      if(LEFT) begin
         Q[3:1] = Q[2:0];  //Shift lower bits (Left Shift)
         Q[0]=!Q[3];    //Circulate inverted MSB to LSB
      end
      else begin
         Q[2:0] = Q[3:1];  //Shift upper bits (Right Shift)
         Q[3] = !Q[0];     //Circulate inverted LSB to MSB
      end
   end

end
```

```
Model Technology's ModelSim executable cannot be found by Project Navigator.
Please go to the 'Edit' menu, select 'Preferences' and then select the 'Partner Tools'
tab. Using this dialog select the ModelSim executable that you wish to use for
```

PALs and GALs never really made it into the world of hobby electronics, despite the fact that these components are instrumental in vast component count reductions, even accepting changes to their contents and so obviating the need to build yet another version of the circuit. Apparently, in the eyes of many hobbyists these advantages do not justify the cost of a suitable programmer, the associated design software and a pile of data books.

CPLDs and FPGAs on the other hand are increasingly found, not only in professional designs but also in hobbyist's projects sent to us for evaluation and eventual publication in *Elektor Electronics*. As we see it, this is not only due to the fact that these components offer far more possibilities than PALs and GALs, but also that nearly all FPGAs and CPLDs are programmable, the relevant manufacturers put free development software at your disposal and — last but not least — *Elektor Electronics* is and remains way ahead of its competitors. Admittedly, a disadvantage of these new chips is that they are usually supplied in SMD cases only.

An extensive package

The one disadvantage we just mentioned is of no consequence if you decide to go for the new development kit from Xilinx. What is called a ‘development board’ actually comprises of the following elements:

– printed circuit board with a CPLD ready fitted
– parallel cable for programming
– development software (ISE Webpack) on CD
– resource CD-ROM crammed with information
– *Programmable Logic Guide*
– battery holder

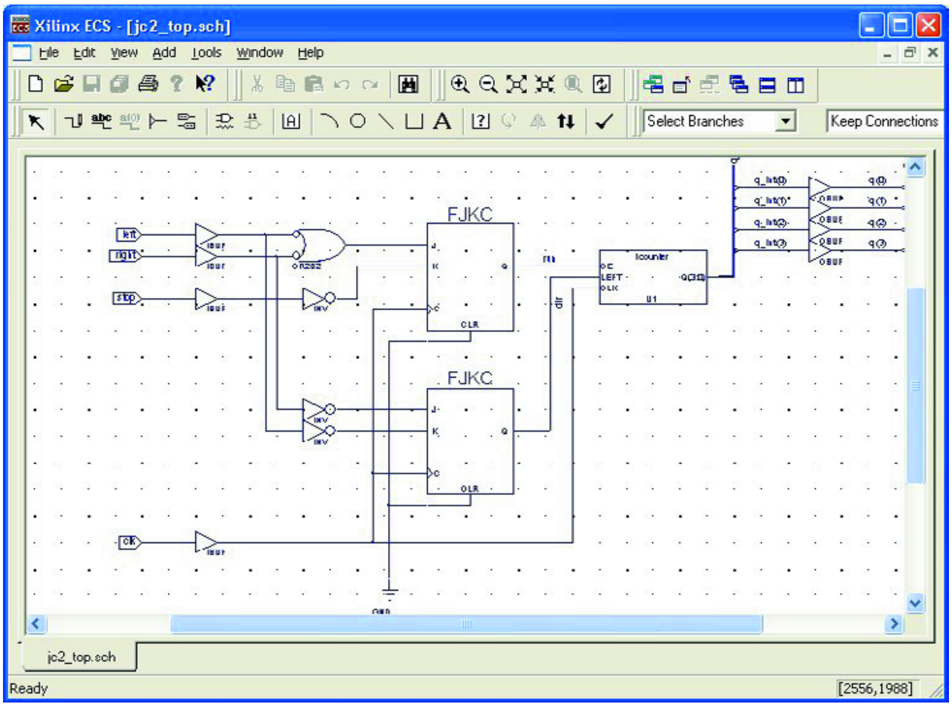
However, the most remarkable thing about this kit is not its contents but its price of just 50 US dollars plus shipping, which means that it should be possible to have one delivered to your doorstep in the UK for about 65 pounds. This price, we feel, really defeats almost any attempt at home construction (just consider the cost and effort that goes into making the board…). Availability is no problem either: simply order your kit directly from the Xilinx Internet shop which also welcomes private customers, using the link:

www.xilinx.com/xlnx/xebiz/onlinestore.jsp?sGlobalNavPick=PURCHASE

On this page, click on ‘Development Boards’ and then on ‘CoolRunner-II Boards’. This will take you to the page showing the development kit covered by this article.

The hardware

The printed circuit board comes with a CPLD type XC2C256TQ144-7 fitted ex-factory. If desired, a second CPLD may be fitted on the board — this may be an XC2C64 or an XC2C32. An oscillator running at 1.8432 MHz supplies the clock signal required by the CPLDs. The oscillator module is fitted in an IC socket allowing it to be easily exchanged if a different clock frequency is in order. In your choice of the oscillator module, do bear in mind the pin connections and the supply voltage (3.3 V).



The power supply may be a DC adapter (mains eliminator) or a battery. Depending on your choice, JP1 may have to be relocated. If an external supply greater than 3.3 V is used, the jumper has to be in the ‘Int’ position (internal stabilisation). When two series-connected 1.5-volt batteries are used, JP1 needs to be moved to the ‘Ext’ (external stabilisation) position. As shown by the indication, the supply voltage is not stabilised in the second case. If a too high supply voltage is applied, components may be damaged (as we learned the hard way), so be careful!

A 25-way sub-D connector is provided to be able to program CPLDs. This connector is linked to the parallel port on the PC using the

cable supplied in the kit. Those of you in possession of another Xilinx JTAG interface may conveniently use the dedicated JTAG connector on the board.

The I/O resources on the board are scanty. One LED and a single pushbutton are connected to the CPLD. Sure, that may be sufficient for a few initial experiments, but the possibilities are of course limited to say the least. Instead of extra I/O, Xilinx have opted for a prototyping area on the board, which allows peripheral hardware to be added quickly and easily. Furthermore, all relevant signals and supply rails are bonded out to pins on four connectors (you have to mount your own 40-way box header, though). These connections are useful if the footprint of your extension circuit exceeds the space offered by the prototyping area.

Software

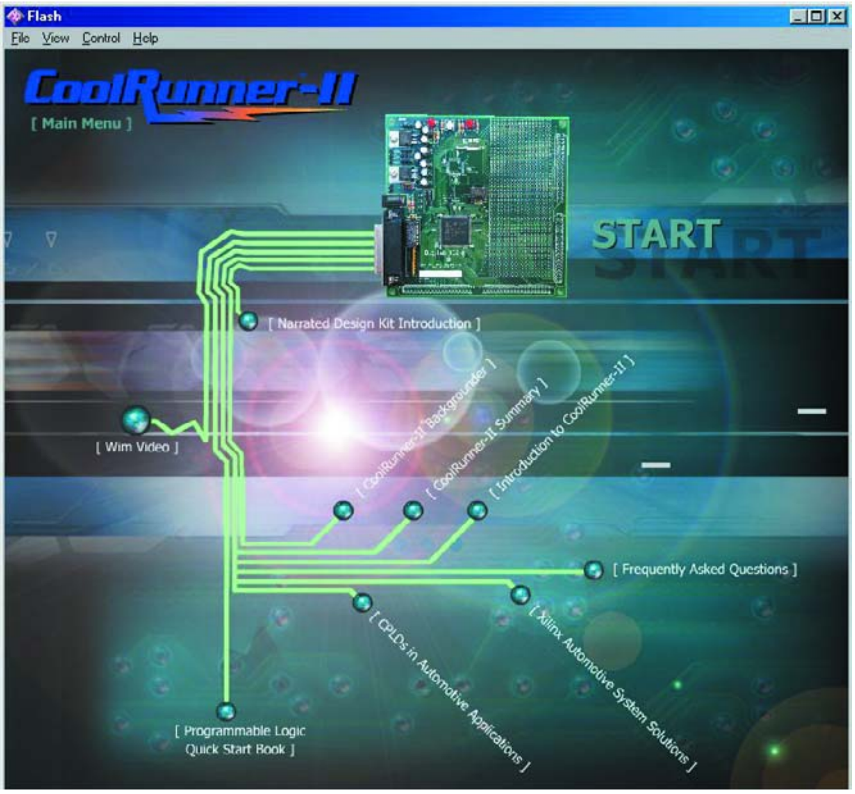
The software that comes with the kit is extremely extensive and distributed across two CD-ROMs. The design software and a number of examples may be found on the CD-ROM labelled 'ISE'. The other CD-ROM contains a multimedia presentation about the development board, together with some additional technical information.

In our case the ISE software suite contained version 5.1. Meanwhile, updates have become available on the Xilinx website, and all users of the kit are encouraged to get these free downloads. During installation you are prompted to register ownership of the product, which is possible by Internet, fax or e-mail.

Within ISE, designs may be entered in a number of ways: Verilog and VHDL are the two languages the software understands. Besides, the software contains its own schematic capture utility that allows a circuit to be drawn in a more conventional way. The state machine editor is a nice bonus feature thrown in by the people at Xilinx. This editor takes the hassle out of designing a state machine. Just draw it, enter the right conditions and hey presto the software generates a valid VHDL file. If you're after bugs or improvements, analysing and/or modifying such a state machine is much easier than examining just about any piece of VHDL code.

Fortunately, ISE also contains a tutorial providing step-by-step guidance on how the software is best used. As usual, it is recommended to complete the tutorial to the very end. Doing so will eventually save you a lot of time searching for the desired function.

To cap it all, ISE also contains a program that allows a CPLD to be easily programmed from a PC. In this way, the entire programming cycle is dealt with by a single software package.


Flash
File View Control Help
CoolRunner-II
[Main Menu]
START
[Narrated Design Kit Introduction]
[Wim Video]
[CoolRunner-II Backgrounder]
[CoolRunner-II Summary]
[Introduction to CoolRunner-II]
[Frequently Asked Questions]
[CPLDs in Automotive Applications]
[Xilinx Automotive System Solutions]
[Programmable Logic
Quick Start Book]

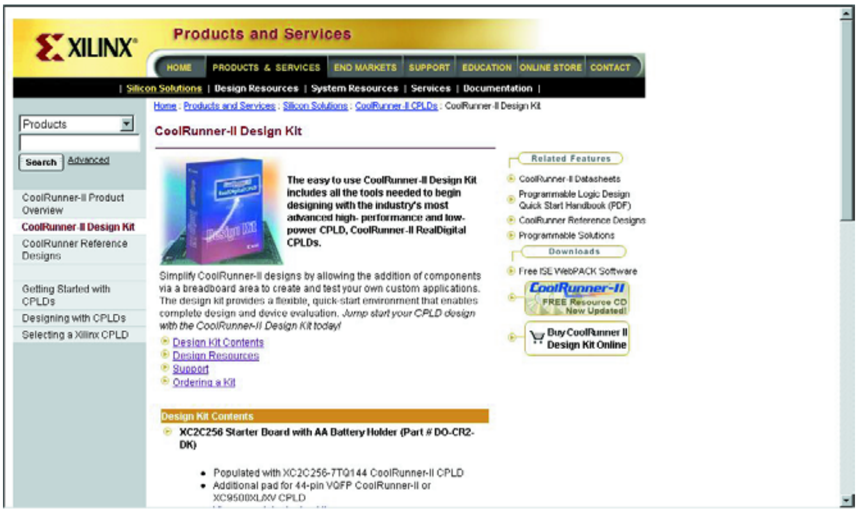
Finally

This development kit is highly recommended if you are interested in CPLDs, or just want to gain experience in describing circuitry in the Verilog or VHDL language. On their website Xilinx also offers a considerable number of free examples for use with ISE. The price of the Xilinx CoolRunner-II kit, its availability and ease of ordering are first-rate and we hope other suppliers of development kits will follow suit.

Here at the *Elektor Electronics* editorial offices we are curious to know what, if any, circuits you have put together using this brilliant development kit, so do let us know if you think you have something worthwhile to show us. Our mailbox, editors@elektor-electronics.co.uk is kept spam-free so has plenty of room for your designs!

In closing we wish you lots of fun with your CPLD experiments.

(030427-1)


XILINX
Products and Services
HOME
PRODUCTS & SERVICES
END MARKETS
SUPPORT
EDUCATION
ONLINE STORE
CONTACT
| Silicon Solutions | Design Resources | System Resources | Services | Documentation |
Home : Products and Services : Silicon Solutions : CoolRunner-II CPLDs : CoolRunner-II Design Kit
Products
Search
Advanced
CoolRunner-II Product Overview
CoolRunner-II Design Kit
CoolRunner Reference Designs
Getting Started with CPLDs
Designing with CPLDs
Selecting a Xilinx CPLD
Related Features
CoolRunner-II Datasheets
Programmable Logic Design Quick Start Handbook (PDF)
CoolRunner Reference Designs
Programmable Solutions
Downloads
Free ISE WebPACK Software
CoolRunner-II FREE Resource CD Now Updated!
Buy CoolRunner II Design Kit Online
Design Kit Contents
Design Resources
Support
Ordering a Kit

CoolRunner-II Design Kit

The easy to use CoolRunner-II Design Kit includes all the tools needed to begin designing with the industry's most advanced high- performance and low-power CPLD, CoolRunner-II RealDigital CPLDs.

Simplify CoolRunner-II designs by allowing the addition of components via a breadboard area to create and test your own custom applications. The design kit provides a flexible, quick-start environment that enables complete design and device evaluation. *Jump start your CPLD design with the CoolRunner-II Design Kit today!*

Design Kit Contents

XC2C256 Starter Board with AA Battery Holder (Part # DO-CR2-DK)

- Populated with XC2C256-7TQ144 CoolRunner-II CPLD
- Additional pad for 44-pin VQFP CoolRunner-II or XC9500XL/XV CPLD